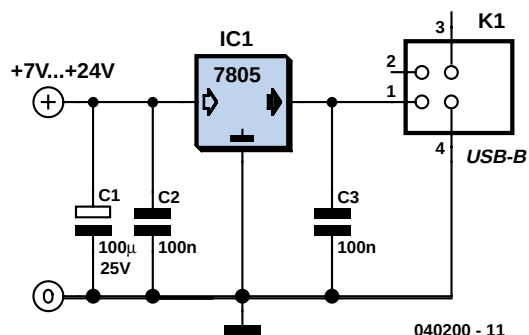
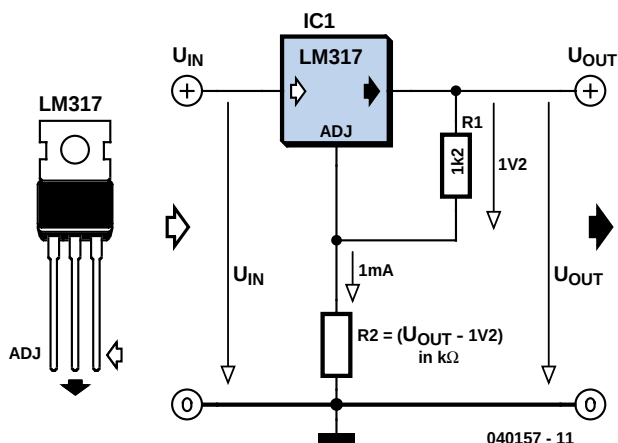




Voltage regulator calculation

Victor Himpe

Before you can design an adjustable voltage regulator into your circuit, or do a redesign, you need to calculate the values for two resistors. This is not difficult in itself, but actually finding the right resistors may pose problems. Fortunately a trick is available to make it all much easier. With most adjustable voltage regulators like the LM317 and LM337, the input voltage has to be 1.2 to 1.25 volts above the desired output voltage. This is because the voltage at the ADJ (adjust) input is internally compared to a reference voltage with that value. The reference voltage always exists across R1. Together with preset R2 it determines the current flowing through the ADJ pin, as follows:

$$V_{out} = V_{REF} [1 + (R2/R1)] + I_{ADJ} R2$$

If for the sake of convenience we ignore I_{ADJ} , enter the reference voltage (1.2 V) and for R1 select a value of one thousand times that voltage (i.e., 1.2 kΩ) then the equation is simplified to:

$$R2 = 1000 (V_{out} - 1.2)$$

In practice, simply determine the voltage drop across R2 (output voltage minus reference voltage) and you get your resistance value directly in kilo-ohms. For example, for 5 V R2 becomes $5 - 1.2 = 3.8$ kΩ which is easiest made by connecting 3.3 kΩ and 470 Ω resistors in series.

In the case of relatively low voltages, smaller resistor values are recommended. This is because sufficient current needs to flow to enable the voltage regulator to do its job. A simple solution is to choose, say, 120 Ω for R1. R2 then becomes:

$$R2 = 100 (V_{out} - 1.2)$$

(040157-1)

Power Supply for USB Devices

Roman Mittermayr

More and more equipment is sold that runs off internal rechargeable batteries. Although a matching charger is usually supplied in the package, there are also devices that can only be charged via a USB port. That is not surprising in the case of USB MP3 players, which have to 'dock' in the PC anyway for some time for the purpose of file transferring. Still, the same 'feature' can be a serious disadvantage, for example, on 'computer-free' holidays.

Sometimes it makes you wonder how simple the solutions to such problems actually turn out to be. After all, if it's just a supply voltage we're after, then a USB port is easily imitated.

The circuit shown here is nothing but a 7805 in a dead standard configuration. The innovation, if any, might be USB connector to which the MP3 player can be connected.

The 7805 comes in different flavours — most devices can supply 1 A, but there are also more advanced variants that achieve up to 1.5 A. Because a USB device is never allowed to draw more than 500 mA from the port

it is plugged into, the circuit shown here should be able to supply charging and/or operating current to up to two (or three) USB devices at the same time.

The input voltage may be a direct voltage of anything between 7 and 24 volts, so for use at home or abroad a simple wall cube with DC output is sufficient. Another useful bit to make yourself might be a cable with an inline fuse and a cigarette lighter plug so you can tap into a vehicle supply (note that this may be up to 14.4 V with a running engine).

At an output current of 1 A and an input voltage of just 7 V, the 7805 already dissipates 2 watts. Assuming you're using the most commonly seen version of the 7805, the TO-220 case with its metal tab will have a thermal resistance of about 50 °C/W. Also assuming that the ambient temperature is 20 °C, the 7805's internal (chip) temperature will be around 120 °C. In most cases, 150 °C is the specified maximum, so ample cooling must be provided especially in a car and with relatively high input voltages.

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